Z. Säugetierkunde 55 (1990) 289–297

ISSN 0044-3468

Records of young hedgehogs (*Erinaceus europaeus* L.) in a private garden

By H. Walhovd

Institute of Zoology and Zoophysiology, University of Aarhus, Aarhus, Denmark

Receipt of Ms. 4. 1. 1990
Acceptance of Ms. 31. 1. 1990

Abstract

Young hedgehogs attracted to a private, suburban garden by supplementary food were recorded over 6 successive autumns. Individual recognition at a distance was made possible using a code pelage marking system. Altogether 55 young were initially recorded in September (n = 6), October (n = 36) and November (n = 13), the earliest and latest occurrence being September 8 and December 6, respectively. Most hedgehogs paid frequent visits to the feeding area during some weeks, though 10 individuals only appeared once.

The initial body weight was mainly less than 500 g. Most young grew heavier during the recorded period. The growth rate averaged 7 g/day in 35 specimens initially captured during September–October, whereas 7 specimens marked during November 1–14 gained 2 g/day. The pre hibernation body weight was 400–800 g. 44 young individuals retired during November.

The spring recapture rate was 47–100 %, averaging 69 %. It is claimed that the food supplemented to the natural diet was not crucial for winter survival. Further, it is maintained that previous estimates of winter mortality in young hedgehogs has been overrated, and there is hardly any indication of low survival rate among young deriving from late born litters.

Introduction

For any hibernator, a critical minimum body weight preceding the cold season is necessary to make winter survival possible. Speculations on this matter may lead to the hypothesis that late born young frequently have particular problems in attaining a sufficient size to prevent winter starvation.

Regarding the hedgehog (*Erinaceus europaeus* L.), Morris (1984) maintains that young from late litters are unlikely to survive the winter. Mortality of young during the cold season has been estimated to be 70 % to 80 % (Hoeck 1987 citing Esser 1984; Obermaier 1985). According to published measurements, however, these winter losses are much less (Kristiansson 1984).

The minimum body weight required for hedgehogs when entering hibernation has been discussed in a public debate in Germany. It was maintained that small young should be actively searched for, rescued and housed from September–October onwards (Nowak 1977; Bestajovsky 1979). Optimal body weight prior to hibernation was claimed to be 700–900 g (Jungbluth 1978; Bestajovsky 1979). Recent scientific literature, however, concludes the German figures to be over-generous, referring to estimates of minimum body weight necessary for winter survival (Morris 1984).

The present capture-mark-recapture study is concerned with the measured body weight increase of young hedgehogs prior to hibernation and their fate during the winter.

Material and methods

Daily records of hedgehogs visiting a private garden (1300 m^2) were kept for 8 summers, i.e. from July 1977 to November 1984. The garden, established 70 years ago, is situated in the town of Ølstykke,

located 30 km to the west of Copenhagen. The town (12 500 inhabitants), is mainly a residential area with some 3500 private houses surrounded by gardens.

Food which attracted the hedgehogs was regularly put out towards sunset every day. The standard diet offered mainly consisted of light bread (400 g) and boiled milk (1 l) with wheat flower to which margarine and sugar were added in minor quantities.

The hedgehogs were fed in a specially constructed food shelter (40 cm high) roofed with two window frames in oblique positions. The broad rectangular entrance (10 × 100 cm) to the shelter was provided with a lamp (12 V, 15 W) and a photo relay. When animals passed by, the broken light beam activated an alarm bell in the private residence. An electric lamp (40 W) illuminated the feeding area. The electric installations facilitated observation of the visiting hedgehogs when records were made i.e. usually between sunset and midnight.

Body weight was the sole criterion used to separate young from adults. During an individual's initial visit to the feeding area, it was permanently marked and sexed and body weight (± 5 g) was ascertained. Over the subsequent period weighing was repeated at irregular intervals, when possible. In order to secure observations of known individuals, a code pelage marking system was used (cf. Parkes 1975; Berthoud 1982). This marking involved clipping the spines from no more than two locations and subsequently painting these areas white or yellow. Thus the hedgehogs could be recognized at a distance without hampering their normal activities.

The observation period mainly comprised the seven months May to November, with occasional records made in April and December. This paper deals only with the young hedgehogs appearing during the six successive autumns 1977 to 1982. The remaining records are dealt with elsewhere.

Results

Altogether 55 young were recorded. The number occurring per year varied between 3 and 19, with highest numbers appearing during two successive autumns (Table 1). The male sex predominated.

The initial records of young were mainly made after the period when numerous adults came into the garden (Fig. 1). All young appeared within the period September 8 to November 29, viz. 6, 36, and 13 in the three months respectively. Ten specimens paid a sole visit to the feeding area, while the great majority appeared more or less regularly during some period of time, i.e. up to more than two months (Fig. 2). In all years there was a peak period for records from early October and the subsequent six weeks. In 1979 when the feeding season was extended, records of 4 young were made in early December. The majority of multiply recorded hedgehogs (n = 45) paid frequent visits to the feeding area, i.e. that they were seen in the garden on most days during their recorded period (Figs. 2 and 3).

Initial body weight tended to be below 500 g and was frequently less than 400 g (Fig. 4). Most young (37) grew heavier during the recorded period, while only 5 specimens were found to lose body weight. The available weight records show that 42 young were weighed twice or more (Table 2). During September and October all but one of the

Table 1. Sex and spring recapture rate of 55 young hedgehogs recorded during six successive autumns

Year	Records			Spring recapture rate	
	N	Sex ♀♀	♂♂	N	%
1977	7	2	5	7	100.0
1978	19	9	10	9	47.4
1979	16	6	10	12	75.0
1980	6	3	3	4	66.7
1981	4	1	3	4	100.0
1982	3	2	1	2	66.7
Sum	55	23	32	38	69.1

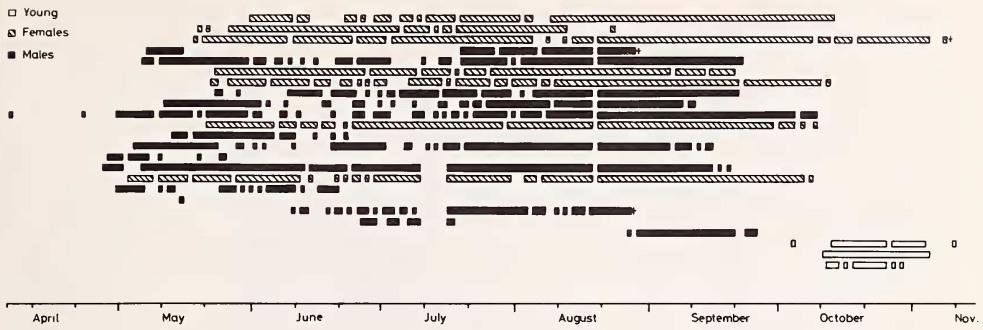

Fig. 1. Records of 21 adult (7 ♀♀, 14 ♂♂) and 3 young hedgehogs in the private garden during the summer of 1982

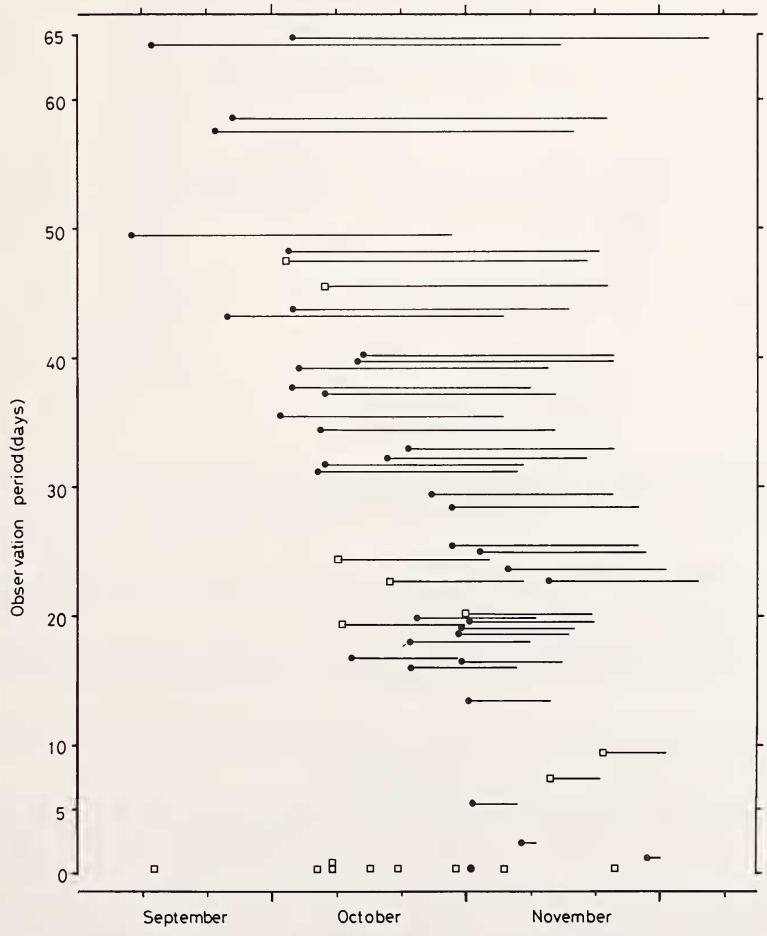

Fig. 2. The day of initial capture of 55 young hedgehogs is either marked with a black circle (specimens re-seen after the winter) or with an open square (non-recaptures in following years). Horizontal lines indicate periods during which 45 multiply recorded specimens were observed

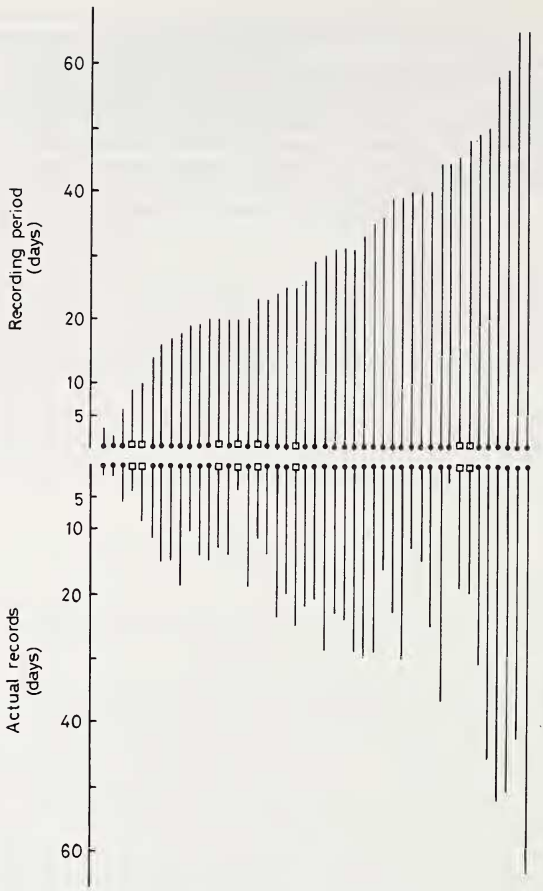

Fig. 3. Vertical lines depict periods through which 45 multiply recorded young were observed, and the number of days each individual was actually seen, respectively. Circles and squares: cf. Fig. 2

multiply weighed specimens increased their body weight. The growth rate of these young averaged 7 g per day. Among those being recorded for the first time in November, the majority hardly put on weight (Fig. 4).

The final body weight, mainly reached during November, amounted to 400–800 g in most young (Fig. 5, Tab. 2). Among 17 young with no further observations in subsequent

Table 2. **The overall increase in body weight of young hedgehogs during autumn, and their spring recapture rate**

N	Dates of weighings		Days of growth (in total)	Body weight increase (g)		Fate after winter	
	initial	final		In total	Individual (average/day)	Recaptured	Unknown
5	8–25 IX	21 X–18 XI	258	1850	7.0	5	0
30	2–30 X	23 X–1 XII	819	6075	7.4	25	5
7	1–14 XI	19 XI–3 XII	114	190	1.7	4	3
13	7 IX–29 XI	none				4	9

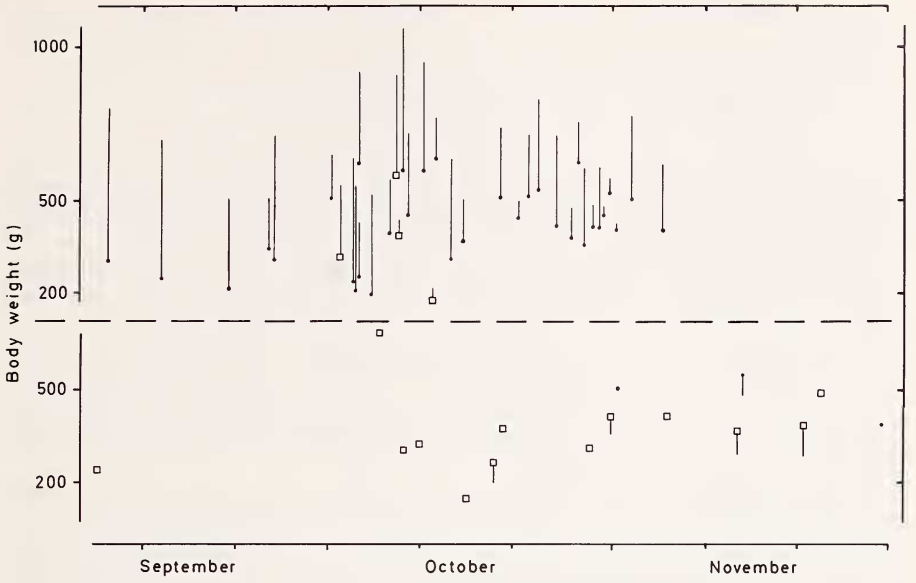

Fig. 4. Circles and squares (cf. Fig. 2) depict date of initial weighing and body weight for 55 young hedgehogs. Vertical lines indicate weight increase (upper) or weight loss (lower) for 42 multiply weighed specimens

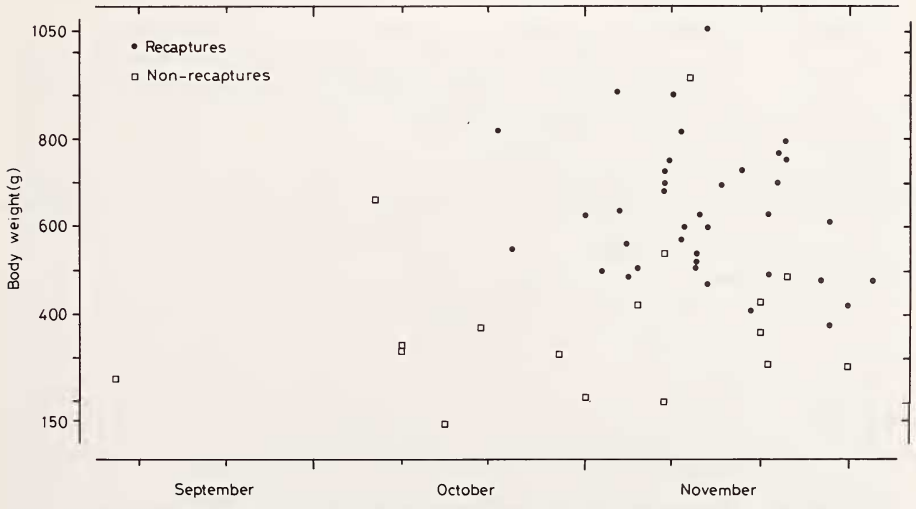

Fig. 5. Circles and squares (cf. Fig. 2) illustrate the latest recorded body weights, during autumn for 55 young hedgehogs (cf. Fig. 4 and Tab. 2)

years, 12 finally weighed between 150 and 380 g. The latest recorded body weights of the remainder were from 380 to 1050 g, their spring recapture rate was 90 %.

On average, 69 % of the young marked in the autumn were recaptured in the following spring. The recapture rate, however, varied greatly between years (Tab. 1). The majority of young (44) was found to enter hibernation during November (Fig. 2). The earliest and

latest final records of overwintering specimens were made on October 21 and December 3, respectively.

Discussion

None of the young recorded appeared with their mother and thus evidently were non-suckling. Furthermore, this indicates that females regularly visiting the garden (cf. Fig. 1) did not bring their offspring to the feeding area. There was no correlation between the number of regularly appearing adult females and the number of young visiting the garden in various years. Hence, it is believed that the number of young recorded (Tab. 1) was casual and did not reflect real fluctuations in juvenile production.

Most young appeared after the period when numerous adult hedgehogs had been recorded (Figs. 1 and 2). During the weeks (Sept. 7–Dec. 3) when the young visited the garden, very few initial records of adults were made, and the period when most young appeared was in succession with the records of adults. Furthermore the body weights alone clearly separated the two age categories.

The initial body weights of young varied from 150 to 700 g (Fig. 4). 29 individuals weighed 400 g or less, mainly below 345 g. This indicates that most initial captures represented recently weaned litters (Morris 1966). As the young remain with their mother for at least 40 days, the 21 earliest captures (Sept. 7–Oct. 10) are most probably from litters born before September 1., i.e. the period when most Danish hedgehogs breed (Walhovd 1984). Another 12 young, initially captured after October 10 with weights of 500–700 g, most likely also derive from the peak breeding season. The remaining 22 young, appearing October 11–November 29, were most probably from late born litters as their initial body weight was only 150–490 g.

Among the 45 young appearing over 2–11 weeks (Fig. 2), 38 were actually seen in the garden on most days, i.e. a frequency of occurrence of more than 50 %. Among these, 11 in particular were feeding often. They had been recorded as non-visiting for 0–5 days only. Obviously, gardens where supplementary food is regularly available attract some hedgehogs more strongly than others (cf. Fig. 1).

On the other hand 12 young were seen at the feeding bowls only once or twice. Furthermore, a few visited the garden on occasional evenings over several weeks (Fig. 3). For instance, no. 19 appeared only on 3 nights during September 24–November 6. These infrequently appearing hedgehogs apparently were not addicted to supplementary food and probably relied mainly on natural food items.

The measured postweaning development varied widely (Fig. 4). Among those young increasing their body weight, 13 put on 290–520 g. The recorded frequency of occurrence at the feeding site for these hedgehogs averaged 80 % and the food supply may have contributed to the enhanced condition of some young (Morris 1985). The natural diet is probably more crucial for winter survival than is supplementary food which alone proved to be an unsuccessful pre hibernation forage among confined young leading to high winter losses (Walhovd 1978). It is most likely, therefore, that the offered food supplemented the natural diet and did not replace it. However, during November when most young retired for the winter (Fig. 2), frequent cool and occasional frosty nights probably reduced the activity of invertebrate life and hedgehogs may have depended more heavily on other sources of food.

Those young losing or hardly gaining weight mainly appeared from mid-October onwards. Their initial size was mostly below 400 g and thus they are likely to have derived from the latest born litters (Walhovd 1984). Cold nights probably affected the foraging activity of these small young more severely than larger individuals (Walhovd 1975).

Postnatal growth of hedgehogs has been studied in a limited number of young raised in

captivity (Herter 1938; Morris 1967; Król 1985). The data available are mainly from the suckling period.

In 10 cases investigated, however, the rapid growth initiated during the lactation period proved to continue after weaning when the young attained body weights of 700–1200 g within 100 days (Herter 1938; Król 1985). Thus, all the young recorded in the garden were probably in the fast-growing phase of their development (Fig. 4). The initial growth of 6 monitored specimens (Król 1985) was 6–8 g/day, which is in accordance with the average daily increase in body weight during September–October of 35 young in the present study (Tab. 2). It should be noted, however, that the growth rate among those putting on weight, varied widely. For example, no. 101 increased by 350 g during October 11–November 2, while no. 66 gained only 230 g during October 4–December 1 despite having visited the feeding bowls on at least 40 nights. The much reduced growth or weight loss of 7 young recorded during November (Fig. 4) may partly be due to frequent near-zero temperatures causing moderate or no surface activity of earthworms (Edwards and Lofty 1976), the most strongly selected prey item of hedgehogs (Wroot 1985).

Measurements of adult and sub-adult home range sizes are plentiful (Parkes 1975; Berthoud 1982; Reeves 1982; Kristiansson 1984; Boitani and Reggiani 1984; Morris 1988) while, to the author's knowledge, movements of recently weaned young hedgehogs never have been monitored. In the present study, captures of numerous young specimens in some years (Tab. 1) makes it likely that they derived from various litters born in different gardens of the town. Frequent occurrence of great variation in body size among initially captured young on successive days suggests that the feeding bowls were discovered fortuitously by solitary living young that may have travelled considerable distances (Morris 1988).

Final records of multiply captured young were made mainly during November, with a few even during December, which is in accordance with other experimental work (Walhovd 1978). However, the previous inclusion of November in the "hedgehog winter" (Walhovd 1975) should be modified. Rather, this month is a period when some young continue natural foraging and gain weight.

After a period of mainly rapid growth, the final body weight of multiple captured animals was roughly 400–800 g (Fig. 4). Thus in Denmark, most young hedgehogs are probably not fully grown before hibernation which seems to contrast with the conditions in England (Morris 1977). The moderate growth or even loss in weight of some young was partly due to their initial late appearance and small size.

The final body weight in autumn of the young recorded to hibernate successfully mainly exceeded 400 g which is in accordance with previous estimates (Morris 1984). These young mostly retired during November after a period of rapid growth (Figs. 2 and 4).

Previous observations indicated a high winter mortality among small, juvenile hedgehogs (Walhovd 1975, 1978). This trend has not been confirmed in the present study, as 69 % were recaptured after their first hibernation season (Tab. 1). Additional young may have overwintered successfully since they were not of particularly small size as compared to others (Fig. 4). These probably derived from distantly born litters which apparently foraged elsewhere, like some recaptured specimens (Fig. 3). The young either losing weight or growing very slowly, however, are likely to have succumbed early in the winter (Fig. 4). A few others from the young missed in spring may have been lost by road accidents since a high road mortality rate was ascertained among the adults recorded in the same garden.

The present study illustrates that trends found during previous experimental work (Walhovd 1978) do not fully reflect the natural hibernation success of young hedgehogs in Denmark. Among the 22 recorded young estimated to have been derived from late born litters, 13 (60 %) were recaptured in spring, and even some more may have hibernated

successfully as already justified. Also, it is possible that previous estimates of winter mortality in young hedgehogs from other sources (e.g. Morris 1984; Hoeck 1987) may have been overrated. In conclusion, the present study supports the view that the hedgehog is extremely well adapted to winter life.

Acknowledgements

My sincere thanks are due to Mrs. Ingrid Christensen and her husband Bernhard for their cooperation over this many years. Dr. Janice G. Mather skillfully gave linguistic advice.

Zusammenfassung

Untersuchungen über junge Igel (Erinaceus europaeus L.) in einem privaten Garten

Durch Futter in einem Villengarten angelockte junge Igel wurden jeweils im Herbst in 6 aufeinanderfolgenden Jahren untersucht. Die individuelle Beobachtung aus der Ferne war durch Markierung der Stachelkleider möglich. Insgesamt wurden 55 Junge gezählt, 6 im September, 36 im Oktober und 13 im November; die ersten Jungen wurden am 8. September, und die letzten am 6. Dezember gesichtet. Die meisten Igel suchten die Futterstelle mehrmals während einiger Wochen auf, 10 wurden nur einmal beobachtet.

Das Anfangsgewicht betrug meistens weniger als 500 g. Die meisten Jungen wurden während der Untersuchungsperiode schwerer. Die Wachstumsrate wurde an 35 Igeln, die in den Monaten September und Oktober gefangen wurden, mit 7 g pro Tag ermittelt. Sieben zwischen dem 1. und 14. November markierte Tiere nahmen nur 2 g pro Tag zu. Das Gewicht vor dem Winterschlaf lag meist zwischen 400 und 800 g. 44 Junge zogen sich im Laufe des Novembers zurück.

Die Rate der im Frühjahr wiedergefangenen Jungigel lag zwischen 47 und 100 %, im Durchschnitt aller Jahre bei 69 %. Die Befunde sprechen dafür, daß die Zufütterung nicht ausschlaggebend für das Überleben im Winter war. Frühere Schätzungen der Wintersterblichkeit junger Igel scheinen zu hoch zu sein. Es gibt kaum Anzeichen für eine niedrige Überlebensrate junger Igel der letztgeborenen Würfe.

References

Berthoud, G. (1982): Contribution à la biologie du hérisson (*Erinaceus europaeus* L.) et applications à sa protection. Université de Neuchatel-Faculté des Sciences. Yverdon-les-Bains.

Bestajovsky (1979): Igel in Pension. Wie hilft man Igeln über den Winter? Stuttgart: Kosmos.

Boitani, L.; Reggiani, G. (1984): Movements and activity patterns of hedgehogs *(Erinaceus europaeus)* in Mediterranean coastal habitats. Z. Säugetierkunde **49**, 193–206.

Herter, K. (1938): Die Biologie der europäischen Igel. Zbl. für Kleintierk. und Pelztierk. **14**, 1–222 (Monographien der Wildsäugetiere 5).

Hoeck, H. N. (1987): Hedgehog mortality during hibernation. J. Zool. Lond. **213**, 755–777.

Jungbluth, J. (1978): Zum Problem der Überwinterung untergewichtiger Jungigel (*Erinaeus europaeus* L.) mit Anmerkungen zu ihren Flöhen. Z. angew. Zool. **65**, 81–85.

Kristiansson, H. (1984): Ecology of a hedgehog *Erinaceus europaeus* population in southern Sweden. Dept. of Animal Ecology, University of Lund, Sweden.

Król, E. (1985): Reproductive energy budgets of hedgehogs during lactation. Zesz. nauk. Filii UW, 48. Biol. 10, 105–117.

Morris, B. (1966): Breeding the European hedgehog *(Erinaceus europaeus)* in captivity. Int. Zoo. Yearbook. **6**, 141–146.

— (1967): The European hedgehog (*Erinaceus europaeus* L.). In: The UFAW handbook on the care and management of laboratory animals. Ed. by W. Lane-Petter, A. N. Worden, B. F. Hill, J. S. Paterson and H. G. Vevers. Edingburgh, London: Livingstone 478–488.

Morris, P. (1983): Hedgehogs. Weybridge: Wittet Books.

— (1984): An estimate of the minimum body weight necessary for hedgehogs *(Erinaceus europaeus)* to survive hibernation. J. Zool. Lond. **203**, 291–294.

— (1985): The effects of supplementary feeding on movements of hedgehogs *(Erinaceus europaeus)*. Mammal Rev. **15**, 23–32.

Morris, P. A. (1977): Hedgehog *Erinaceus europaeus*. In: The handbook of British mammals. Ed. by G. B. Corbet and H. N. Southern. Oxford: Blackwell 29–36.

— (1988): A study of home range and movements in the hedgehog *(Erinaceus europaeus)*. J. Zool. Lond. **214**, 433–449.

Nowak, W. (1977): Zur Haltung von untergewichtigen Herbstigeln (*Erinaceus* sp.). Eine Vergleichsstudie. Z. angew. Zool. **64**, 101–103.

Parkes, J. (1975): Some aspects of the biology of the hedgehog (*Erinaceus europaeus* L.) in the Manawatu, New Zealand. N. Z. J. Zool. **2**, 463–472.
Reeve, N. (1982): Radio tracking studies of the hedgehog. In: Radio-Tracking of Vertebrates. Ed. by C. L. Cheeseman and R. Milson, Proc. Symp. Zool. Soc. London.
Walhovd, H. (1975): Winter activity of Danish hedgehogs in 1973/74, with information on the size of the animals observed and location of the recordings. Natura Jutlandica **18**, 53–61.
— (1978): The overwintering pattern of Danish hedgehogs in outdoor confinement, during three successive winters. Natura Jutlandica **20**, 273–284.
— (1984): The breeding habits of the European hedgehog (*Erinaceus europaeus* L.) in Denmark. Z. Säugetierkunde **49**, 269–277.
Wroot, A. J. (1985): Foraging in the European Hedgehog, *Erinaceus europaeus*. Mammal Rev. **15**, 2.

Author's address: Dr. Helge Walhovd, Institute of Zoology and Zoophysiology, Zoological Laboratory, Building 135, University of Aarhus, DK-8000 Aarhus C, Denmark